AKBP 12: Radiofrequency and Instrumentation I

Time: Friday 9:00–10:30 Location: ZHG004

AKBP 12.1 Fri 9:00 ZHG004

Refurbishment of TESLA Cavities for future ERL upgrades at MESA (*)(**) — •Paul Plattner, Florian Hug, and Timo Stengler — Institut für Kernphysik, Mainz, Deutschland

A future upgrade from 1 mA to 10 mA beam current is planned for the Mainz Energy-Recovering Superconducting Accelerator (MESA), an Energy-Recovering (ER) LINAC. Calculations show a potential limitation of the Higher Order Mode (HOM) antennas, which couple the stored power from HOM out. Through the upgrade of the beam current a quench at the HOM antenna would happen. This limit can be increased by using a superconducting material with a higher ctritical temperature than Niobium. For the studies are chosen NbTiN and Nb3Sn, which are applied as a thin film on substrates like Niobium and Copper. The modified antennes will be tested in an cryomodule from the decomissioned ALICE. This cryomodule need to be refurbished and modified for fulfill the requirements for MESA. (*)We would like to thank STFC Daresbury for their generous gift. (**)The work received funding by BMBF through 05H21UMRB1.

AKBP 12.2 Fri 9:15 ZHG004

Development of a new Chopper Cavity for the S-DALINAC* — •Vincent Pruy, Michaela Arnold, Adrian Brauch, Manuel Dutine, Ruben Grewe, Katharina E. Ide, Lars Jürgensen, Clemens M. Nickel, Norbert Pietralla, Felix Schliessmann, and Dominic Schneider — Institut für Kernphysik, Technische Universität Darmstadt, Darmstadt, Germany

The operation of the superconducting radio-frequency cavities of the S-DALINAC relies on a bunched electron beam. Currently, the continuous beam generated by the thermionic gun is divided into bunches using a chopper system incorporating a single deflecting cavity. However, this system induces nonlinear curvatures to the beam trajectory. To mitigate this effect, a second, identically constructed deflecting cavity can be employed to re-bend the beam thus counteracting the nonlinear distortions. This work focuses on an excellent deflection behavior and quality factor of the cavity by performing electromagnetic and particle tracking simulations. In this contribution, we report on the progress in the simulation and design of such a double-cavity chopper system. *Work supported by DFG (GRK 2128, IRTG 2891) and State of Hesse (Research Cluster ELEMENTS (Project ID 500/10.006)).

AKBP 12.3 Fri 9:30 ZHG004

Performanceverbesserung der 6-zelligen Einfangstruktur des S-DALINAC durch Anpassung der Kopplerlängen* — •Lukas Reichel, Michaela Arnold, Manuel Dutine, Ruben Grewe, Katharina E. Ide, Lars Jürgensen, Norbert Pietralla, Felix Schliessmann und Dominic Schneider — Institut für Kernphysik, Technische Universität Darmstadt, Darmstadt, Germany

Der supraleitende Injektorbeschleuniger des S-DALINAC besteht aus einer 6-zelligen Einfangstruktur und zwei 20-zelligen Beschleunigungsstrukturen. Der 6-Zeller ist auf ein relativistisches Geschwindigkeitsverhältnis von $\beta = 0{,}86$ ausgelegt und beschleunigt die eintreffenden Elektronen so weit vor, dass sie von den auf $\beta = 1$ ausgelegten 20-Zellern angemessen weiterbeschleunigt werden können, weshalb er großen Einfluss auf die Strahlqualität hat. Bei der Inbetriebnahme des 6-Zellers wurde festgestellt, dass die Güte und die maximale Feldstärke deutlich unter den erwarteten Werten lagen. Des Weiteren waren die ausgekoppelte Leistung und der Wärmeeintrag in das Heliumbad problematisch hoch, sodass ein Betrieb nur mit einem reduzierten Energiegewinn durch die Einfangstruktur möglich war. Durch ein gezieltes Kürzen der Ein- und Auskopplerlänge konnte die maximale Feldstärke ungefähr um den Faktor 2,9 erhöht und die ausgekoppelte Leistung deutlich reduziert werden. In diesem Vortrag werden die Vergleichsmessungen, die vorgenommenen Änderungen und deren Ergebnisse vorgestellt und diskutiert.

*Work supported by DFG (GRK 2128, IRTG 2891) and State of Hesse (Research Cluster ELEMENTS (Project ID 500/10.006)).

AKBP 12.4 Fri 9:45 ZHG004

Helium Level Stabilization System of Cryomodule for HELIAC — •Szymon Kowina[1], Maksym Miski-Oglu[1], Thorsten Kuerzeder[1,2], and Viktor Gettmann[1] — [1]GSI, Darmstadt, Deutschland — [2]HIM, Mainz, Deutschland

The superconducting heavy-ion HELmholtz LInear ACcelerator (HELIAC) is designed to meet the needs of the Super Heavy Element (SHE) research and materials science user programs at GSI in Darmstadt. The beam energy can be varied smoothly between 3.5 and 7.3 MeV/u, with an average current of up to 1 emA and a duty cycle of 100 %. Recently, the first cryomodule, CM1, was fully commissioned and tested. CM1 comprises three Crossbar H-mode (CH)-type accelerator cavities, a CH-rebuncher, and two superconducting solenoid lenses. The focus of this contribution is on the details of the liquid helium stabilization system of CM1.

AKBP 12.5 Fri 10:00 ZHG004

Co-sputtering of Nb_3Sn thin films on copper for superconducting HOM antenna application — •Amir Farhood[1], Alexey Arzumanov[1], Márton Major[1], Paul Plattner[2], Florian Hug[2], Timo Stengler[2], and Lambert Alff[1] — [1]Institute of Materials Science, TU Darmstadt, 64287 Darmstadt, Germany — [2]Institut für Kernphysik, Johannes Gutenberg-Universität Mainz, D-55128 Mainz, Germany

For superconducting (SC) accelerators working in continuous wave (CW) mode the power coupled at the higher order mode (HOM) antennas is a power limiting factor. In particular, HOM antennas could quench in energy-recovery operation at high beam currents. Calculations showed that HOM antennas coated with a superconducting film can increase the possible maximal deposited power in HOMs. For this study a copper HOM antenna model was coated with SC Nb_3Sn thin film by co-sputtering. The sputtering system was modified to achieve homogeneous coating of the three-dimensional antenna. Since stoichiometry plays a significant role on the critical temperature of the coating, the Nb to Sn ratio was checked by energy dispersive spectroscopy (EDS) measurements on test samples attached to different areas of the model antenna. The temperature dependence of resistivity and magnetization was measured on the test samples. A minimum critical temperature (T_c) of 13 K at every part of model was shown and on the top part of the antenna, where the heat load is the largest (T_c) of 14.5 K and critical field (H_{c1}) of 150 mT (at 5K) were achieved.

AKBP 12.6 Fri 10:15 ZHG004

Nb_3Sn thin films grown by co-sputtering for SRF cavity application — •Márton Major[1], Alexey Arzumanov[1], Amir Farhood[1], Michaela Arnold[2], Norbert Pietralla[2], and Lambert Alff[1] — [1]Institute of Materials Science, Technical University of Darmstadt, Darmstadt, Germany — [2]Institute of Nuclear Physics, Technical University of Darmstadt, Darmstadt, Germany

Superconducting (SC) RF cavity technology is dominated by bulk Nb due to its proven physical performance and mature production technology. Needs for reducing the energy consumption of particle accelerators, however, call for alternative SC materials, such as Nb_3Sn, to allow their operation at higher temperatures at lower cryogenic costs. The Nb_3Sn coating of carrier structures has a huge potential to reach high acceleration gradients even at 4.2 K. Utilizing thin film technology enables to use copper, an excellent heat conductor, for the bulk of the cavity to which Nb_3Sn can be sputtered for high-quality SC coatings. However, several key technological and physical challenges must be mastered to coat the hollow body of a cavity from inside. At our group, based on a low-temperature magnetron co-sputtering process, the direct deposition of SC Nb_3Sn on Cu became possible. The grown films had high critical fields and critical temperatures. Presently we are scaling up the coating process from small substrates to larger structures, like HOM antennae and QPR cups.

This work was supported by the BMBF through grant 05H21RDRB1 and by the DFG via the Research Training Group GRK 2128 "AccelencE", project No. 264883531.